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Toshihiro Umebayashi, Yasuhiro Utsumi, and Yuzou Sano
Experimental Evidence of the Impacts of Different Root-Pruning Intensities on Post-Transplant Water Potential and Xylem Hydraulic Conductivity in Two Tree Species 471

Abstract. To improve transplanting techniques, it is necessary to understand root-pruning induced declines in xylem water transport and post-transplant environmental effects. In this study, we evaluated the relationship between water potential and hydraulic conductivity (K_s) in saplings of *Larix kaempferi* and *Betula maximowicziana*, whose roots were pruned in order to improve our understanding of the transplanting technique. Root-pruning treatments were applied to saplings of both species based on their basal root diameters. After transplanting, the water potential and K_s were measured. In addition, the vulnerability curve was obtained using a centrifuge method by quantifying the relationship between decreasing xylem pressure and the percentage loss of K_s, allowing a comparison of water stress tolerance between the two species. *Betula maximowicziana* had higher K_s and was more vulnerable to water stress induced embolism than *L. kaempferi*. In *L. kaempferi*, no decrease in K_s was observed regardless of the level of root pruning, and all saplings survived after transplanting. In *B. maximowicziana*, saplings subjected to root pruning exhibited a decline in the water potential during midsummer, along with a reduction in K_s. Moreover, the number of dead saplings increased with increasing levels of root pruning. For the two species, a relationship was found between increasing level of root pruning and post-transplant mortality in the more water stress vulnerable species, *B. maximowicziana*. The relationships among post-transplant changes in water potential, reductions in K_s associated with root pruning, and sapling survival provide a useful framework for selecting transplanting methods and improving transplant success rates.

Keywords. *Betula maximowicziana*; *Larix kaempferi*; Root Pruning; Transplant; Vulnerability Curve.

Chad M. Rigsby, Jacob Kulp, Amber R. Stiller, Cory McCurry, Michael J. Sherwood, Christopher B. Riley, Jeremy D. Slone, and Kevin D. Chase
Preventing Defoliation by Spongy Moth (*Lymantria dispar*) with Systemic Insecticides and Their Interaction with Nitrogen Supplementation 484

Abstract. Background: Spongy moth (*Lymantria dispar* L.) is an exotic, outbreak pest in North America, where it causes defoliation and mortality of trees. The management tools for this insect on residential and commercial properties as well as small woodlots include the use of systemic insecticides to protect against severe defoliation during an outbreak. Methods: We evaluate the ability of acetamiprid (TriStar® 8.5 SL; Nufarm, Alsip, IL, USA) applied as a bark spray in the spring; acephate applied as either a soil injection (Lepitect™; Rainbow Ecoscience, Minnetonka, MN, USA) or root flare injection (Lepitect Infusible™; Rainbow Ecoscience) in the spring; and emamectin benzoate (Mectinite®; Rainbow Ecoscience) applied as a root flare injection either in the previous fall or spring to prevent defoliation of mature northern red (*Quercus rubra*) and white (*Q. alba*) oaks during a spongy moth outbreak. We also evaluated any potential influences of nitrogen (N) supplementation on the efficacy of acetamiprid and fall emamectin benzoate treatments to prevent defoliation by spongy moth. Results: No effect of N supplementation on foliar N levels or insecticide efficacy was detected. All insecticide treatments, except for bark-applied acetamiprid, were able to significantly reduce spongy moth defoliation relative to nontreated controls, though there were statistical and numerical differences between treatments. Conclusion: These results demonstrate that N supplementation requires further study but did not influence insecticide efficacy in our study and that acephate and emamectin benzoate are both effective at preventing defoliation, but due to variation between treatments, considerations should be made regarding the timing and method of application.

Keywords. Defoliation; Nitrogen Fertilization; Spongy Moth; Systemic Pesticide.

Paula Daniele Martins Moraes, Hiago Felipe Cardoso Pacheco, Julia Isabella de Matos Rodrigues, Joathan Cipriano Castro, José Rozendo de Lima Silva, Francisco de Assis Oliveira, and Walmer Bruno Rocha Martins
Legacy Effects and Shifts in Urban Planning: Comparing Old and New Public Squares in Belém, Northern Brazil 496

Abstract. Background: Urban public squares play a vital role in the socio-environmental development and quality of cities. The city of Belém, Pará, Brazil, was initially afforested with mango trees (*Mangifera indica* L.) at the turn of the 19th to the 20th century in order to reduce air temperature and enhance urban aesthetics. This study evaluated the floristic composition of 10 public squares (5 old and 5 new) in Belém.

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Methods: All tree individuals with circumference at breast height (CBH) ≥ 16 cm were inventoried, and floristic composition, species richness, density, and diversity were analyzed. Results: A total of 767 individuals belonging to 51 species and 27 families were recorded, with 567 individuals found in old squares (37 species) and 200 in new squares (31 species). Fabaceae was the most frequent family. Exotic species predominated (55.5% in old squares and 36% in new squares), such as *M. indica*, reflecting the low incentive for the use of native species. Floristic similarity between old and new squares was confirmed by rarefaction analyses and nonmetric multidimensional scaling (NMDS); however, this similarity was mainly associated with *Handroanthus heptaphyllus* (Vell.) Mattos (a species not native to the Amazon) rather than *M. indica*. Conclusion: The reduction in urban tree cover over time was related to the lack of management and inadequate species selection. Thus, the persistence of exotic species highlights the continuity of the legacy effect and the devaluation of native species, indicating the need for public policies that prioritize native flora in order to ensure urban biodiversity and sustainability.

Keywords. Floristic Composition; *Handroanthus heptaphyllus*; *Mangifera indica*; Urban Green Areas; Urban Silviculture.

Richard W. Leopold, PhD, Atomu J. Saul, and Jason C. Grabosky, PhD
Resistance Drill Tree Ring Analysis of American Sweetgum, Norway Spruce, and Pin Oak with the Application of a LOESS Regression 510

Abstract. Background: Resistance drills are a tool that can detect the differences in density of early wood and late wood in tree ring formation to determine quantity and thickness of annual rings formed by growing trees. In this paper we assessed the ability of the drill to detect tree rings from 3 species of different wood profile types: temperate ring-porous, diffuse porous, and temperate conifers. Methods: Core samples and resistance drill profiles were collected from American sweetgum (*Liquidambar styraciflua* L.); Norway spruce (*Picea abies* [L.] H.Karst.); and Pin oak (*Quercus palustris* Münchh.) as samples of these wood profile types. The total number of rings from the core samples were counted, and a LOESS regression was applied to the resistance drill profiles to detect and count the total number of annual rings. Results: The results showed the resistance drill underestimated the number of annual rings in all 3 species. Conclusions: Consistent with previous literature, the resistance drill was found to underestimate annual rings when compared to physical core samples. Although the LOESS regression resulted in the exclusion of several rings from the resistance drill profile, the rings size of less than 1 mm appeared to be a more impactful variable. Currently, the use of resistance drills to acquire annual tree ring measurements is acceptable at a population level for broad assessments. However, increased accuracy in the resistance drill's ability to detect small rings and more clearly denote ring boundaries could increase the viability of this tool for individual dendrochronology.

Keywords. Data Collection; Dendrochronology; IML-RESI PD 400; *Liquidambar styraciflua*; LOESS Regression; *Picea abies*; *Quercus palustris*; Wood Porosity.

Emily M. Russavage, Emily J. Wallis, Melissa Benzinger McGlynn, Christopher B. Riley, Michael J. Raupp, Phillip A. Lewis, and Paula M. Shrewsbury
Evaluating *Beauveria bassiana* Mycoinsecticides Against Spotted Lanternfly (*Lycorma delicatula*) Adults, Nymphs, and Eggs in Semi-Urban Areas 521

Abstract. Background: The spotted lanternfly (*Lycorma delicatula*)(SLF) is an invasive planthopper that is spreading in the United States over recent years. Not only is SLF a nuisance pest in urban areas, but its feeding causes millions of dollars in damage to the forestry, ornamental plant, and viticulture industries annually, necessitating research on effective and sustainable control methods. The fungal pathogen *Beauveria bassiana* was previously found to infect and kill SLF. Our study sought to evaluate commercially available *B. bassiana* mycoinsecticides against various SLF life stages. Methods: In field trials, SLF were either directly sprayed with mycoinsecticides or exposed to 24-hour old mycoinsecticide residues on trees. We documented mortality over time, as well as the percentage of *B. bassiana*-infected individuals. Results: Direct contact sprays of *B. bassiana* strain GHA killed 95% of SLF adults after 2 weeks. Approximately 34% of early instar nymphs were killed after 9 days. However, laboratory testing confirmed that > 70% of nymphs were infected with the *B. bassiana* fungus. Late instar nymphs and adults exposed to residuals were infected at averages of 20% and 7% respectively, suggesting that mycoinsecticide tree bark sprays are not effective and quickly deteriorate within 24 hours. There was no effect of *B. bassiana* applications on egg hatch rate and only 16% of emerging hatchlings were infected. Conclusions: Our results indicate that direct contact spray applications of *B. bassiana* strain GHA can effectively kill SLF adults and nymphs under field conditions.

Keywords. Biological Control; Entomology; Entomopathogen; Invasive Insect; Pest Management.

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Sharon C. Danielson, Milos Simovic, Kevin Mueller, and Juliana S. Medeiros
Physiological Response of Trees to Seasonal Variation Reveals Native Species Are Suitable for Urban Parks That Resemble Natural Sites 537

Abstract. Background: Cities are hotter and have poor soil compared to surrounding natural areas, necessitating identification of stress-tolerant species suitable for urban plantings. Species selection based on physiology is highly informative, but also time-consuming, so quick-to-measure proxies are needed. Further, parks may represent relatively less stressful locations where native trees could be included to increase urban biodiversity. Methods: We examined seasonal physiological responses of leaf hydraulic conductance, turgor loss point (Ψ_{TLP}), and gas exchange for 3 Northeastern Ohio species (*Acer rubrum*, *Acer saccharum*, and *Nyssa sylvatica*), one Southeastern United States (US) species (*Liquidambar styraciflua*), and one East Asian species (*Pyrus calleryana*) growing at 2 parks in Northeast Ohio. We compared these with published growth, leaf dry matter content (LDMC), and carbon:nitrogen ratio (CN) data for the same trees in our study. Results: Lakeview soil was most similar to surrounding natural areas, but both parks had higher soil bulk density and sand percentage compared to a nearby forest. At both parks, physiology was related to soil properties. Our seasonal analysis showed that water stress was mitigated via seasonal physiological adjustments at both parks. *Pyrus calleryana* was not distinguished from *Liquidambar styraciflua* and *Nyssa sylvatica*. Principal component analysis showed positive correlations of LDMC with growth and Ψ_{TLP}, and CN with carbon sequestration. Conclusions: Our study demonstrates suitability of Ohio and Southeastern US species for Northeastern Ohio parks, despite the presence of some compacted soil. In addition, we suggest LDMC and CN could be useful physiological proxies for broadscale analysis of tree suitability for urban environments.

Keywords. Leaf Hydraulic Conductance; Photosynthetic Efficiency; Species Selection; Turgor Loss Point.

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